Iowa's WQS Review
- Aquatic Life Criteria

By

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Outlines

- Designations and Chemicals Addressed
- Methodology for Site-specific Criteria
- Cladocera Issue
- ESA Consultation
- Example Criteria Recalculation
- Results Discussion
- Implementation and Safety Factors
- TAC Members Group Discussions

Designations & Chemicals Addressed

- **March 22, 2006 WQS Rule:**
  - **Designation Name Changes**
    - **Class B(WW) ? Class B(WW-1)**
    - **Class B(LR) ? Class B(WW-2)**
    - **New Class B(WW-3) for intermittent streams with perennial pools**
  - **Numerical Criteria changes (Table 1, Chapter 61)**
    - **B(WW) Criteria = B(WW-1) Criteria**
    - **B(LR) Criteria = B(WW-2), B(WW-3) Criteria**

- **Address Criteria for Class B(WW-1), B(WW-2) and B(WW-3) designations**

Designations & Chemicals Addressed

Chemicals: Metals, Pesticides and Chlorine

- Arsenic, Cadmium, Arsenic, Cadmium, Chromium III, Chromium VI, Copper, Lead, Mercury, Nickel, Selenium, Silver, Zinc, Cyanide, Pentachlorophenol, Aldrin, Chlordane, 4-4'-DDT, alpha-Endosulfan, beta-Endosulfan, Endrin, Heptachlor, Heptachlor Epoxide, Polychlorinated Biphenyls (PCBs), Toxaphene, Aluminum, and Chlorine Chromium VI, Copper, Lead, Mercury, Nickel, Selenium, Silver, Zinc, Cyanide, Pentachlorophenol, Aldrin, Chlordane, 4-4'-DDT, alpha-Endosulfan, beta-Endosulfan, Endrin, Heptachlor, Heptachlor Epoxide, Polychlorinated Biphenyls (PCBs), Toxaphene, Aluminum, and Chlorine

Methodology for Site-specific Criteria

EPA recommends three methods:

1. The Recalculation Procedure
   - Desktop approach

2. The Water-Effect Ratio Procedure
   - Require comprehensive toxicity data on both lab water and ambient water

3. The Resident Species Procedure
   - Combination of procedure #1 and #2

Procedure #1 is applied in this criteria review

Methodology (Cont'd)

- National Dataset for Each Chemical
  - Acute toxicity, LC50 or EC50
  - Limited chronic toxicity
- Species Deletion
  - Only include resident species "occur at the site"
- Eight-Family Rule
  - To ensure that different species and genus are represented in the criteria recalculation
- Statistical Procedure for FAV
  - Usually use the four lowest LC50 values (or the four most sensitive species LC50 values)

Methodology (Cont'd)

- "Occur at the Site"
  - are usually present
  - are present at the site only seasonally due to migration
  - are present intermittently because they periodically return to or extend their ranges into the site
  - were present at the site in the past, are not currently present at the site due to degraded conditions
  - are present in nearby bodies of water, are not currently present at the site due to degraded conditions

Methodology (Cont'd)

- Eight - Family Rule
  - The family Salmonidae in the class Osteichthyes (Phylum Chlordata)
  - A second family in the class Osteichthyes, preferably a commercially or recreationally important warm water species (e.g., bluegill, channel catfish, etc.)
  - A third family in the phylum Chordata (may be in the class Osteichthyes or may be an amphibian, etc.)
  - A planktonic crustacean (e.g., cladoceran, copepod, etc.)
  - A benthic crustacean (e.g., ostracod, isopod, amphipod, crayfish, etc.)
  - An insect (e.g., mayfly, dragonfly, damselfly, stonefly, caddisfly, mosquito, midge, etc.)
  - A family in a phylum other than Arthropoda or Chordata (e.g., Rotifera, Annelida, Mollusca, etc.)
  - A family in any order of insect or any phylum not already represented

Methodology (Cont'd)

- Derivation of Criteria

  A criterion consists of two concentrations
  - Acute Criterion (or CMC)
  - Chronic Criterion (or CCC)

- Acute Criterion = ½ of the FAV

- Chronic Criterion = FAV/(acute-chronic ratio)

  Acute-chronic ratio (or ACR) is the ratio of LC50 divided by the chronic value for the same species for the chemical

Cladocera Issue

- All Cladocera deleted in previous criteria review in Iowa
- No direct sampling data in Iowa streams
- More relevant to Class B(WW-2) & B(WW-3)
- A thorough Literature Search conducted for this review
- Mainly *Daphnia spp*. and *Ceriodaphnia spp*. (Usually the most sensitive)

Cladocera Issue (Cont'd)

- EPA 1985 Region 7 Standard Operating Procedure for Site-specific Criteria:
  - Zooplankton community in streams dominated by rotifers
  - Copepoda & Cladocera: upstream release from lakes and/or impoundments
- Expert Opinions
  - ISU Professors Dr. Gary Atchison and Dr. Joseph Morris
  - Resident only in Backwater of large rivers or reservoirs
- Research Papers by Midwest Experts
  - Found Daphnia spp. not Ceriodaphnia spp. in small wadable streams

Cladocera Issue (Cont'd)

- Topeka Shiner Diet Study
  - Insects, midges, mayflies are the main diet
  - Microcrustacean not the main diet
  - *Ceriodaphnia spp*.
    - Not found in the headwater stream
    - Only found in a farm pond and a tributary drain out of a reservoir

- For Criteria Recalculation:
  - All Daphnia spp. retained
  - Ceriodaphnia spp. retained only for B(WW-1)

ESA Consultation

- USFW Endangered Species Act (1973), Section 7:
  - In consultation with USFW
  - To ensure actions not jeopardize listed species or affect critical habitat
  - Between USFW and EPA

- Aquatic life species and aquatic life dependent species

ESA Consultation

- Measures Taken to meet ESA:
  - To protect aquatic life dependent species:
    - For all bioaccumulative chemicals, the Final Residue Value adopted for Chronic Criteria
  - For Class B(WW-1):
    - Proposed 304(a) criteria for all chemicals except Cadmium
    - For Missouri River, Cadmium criteria proposed for Missouri River protecting Pallid Sturgeon
  - Topeka Shiners:
    - Rainbow trout and/or species in the same family used as surrogate species

Example Criteria Recalculation - Copper

- The national dataset has 43 genus species
- Non-resident species: Coldwater species, *Guppy* and *Tilapia*
- All *Daphnia spp.* are retained for the three designations
- *Ceriodaphnia spp.* kept for Class B(WW-1)
- *Rainbow trout* used as surrogate species for Topeka Shiner

Recalculated Copper Criteria for Iowa

Table 1. Current and Recalculated Copper Criteria at Hardness of 100 mg/l as CaCO3

Criteria	Class B(WW-1)		Class B(WW-2)		Class B(WW-3)		EPA Criteria (as total)
	Current	Proposed	Current	Proposed	Current	Proposed	Current
Acute	60	14	90	17.7	90	17.7	14
Chronic	35	9.3	55	11.8	55	11.8	9.3

Factors Affect Recalculation Effect of Sensitive Species

- If the Sample Size < 59, only the four most sensitive species toxicity affect the recalculation

- The lower the EC50s of the four most sensitive species, the lower the recalculated criteria

Factors Affect Recalculation Effect of Sample Size (n)

- Some cases resulted in criteria more stringent than 304(a) when less stringent species are deleted
  - Reasons:
    - As n ? , the recalculated criteria ?
    - The deficiency of small sample size in statistical analysis methodology
    - 304(a) criteria are proposed since they are the most protective recommended by EPA
    - The 304(a) criteria are protective of the resident species

Recalculated Chromium Criteria

Table 2. Current and Recalculated Chromium VI Criteria

Criteria	Class B(WW-1)		Class B(WW-2)		Class B(WW-3)		EPA Criteria(as total)
	Current	Proposed	Current	Proposed	Current	Proposed	Current
Acute	60	16	300	20	300	20	16
Chronic	40	11	200	13	200	13	11

Results Discussion

- For all but six metals, 304(a) Criteria proposed
- For the six metals (Cadmium, Chromium, Copper, Mercury, Zinc and Aluminum)
  - Recalculated criteria are 2.5 to 15 times more stringent than the current criteria
  - For hardness dependent metals, criteria proposed as an equation dependent of hardness
- All metal criteria expressed as Total Recoverable

Implementation and Safety Factors

- Conservatism in stream design low flows
- Conservatism in prohibition of mixing zone and Zone of Initial Dilution for bioaccumulatives and critical habitat, mussel beds, etc.
- Conservatism in using lab dilution water
- Conservatism in applying total metal criteria
- Conservatism in surrogate species for Topeka Shiner

Questions &
TAC Group
Discussions???